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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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EXAMINER	
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ART UNIT	PAPER NUMBER
1795	

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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/758,843	WARRIER ET AL.	
	Examiner	Art Unit	
	Jonathan S. Crepeau	1795	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 March 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1,4-24,49 and 52-60* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,4-24,49 and 52-60* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date 9/4/07.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/11/08 has been entered.

This Office action addresses claims 1, 4-24, 49, 52-58, and newly added claims 59 and 60. The rejection of claims 4-9, 28-33, and 52 under 35 USC 112, second paragraph has been reconsidered and is withdrawn. However, claims 1, 4-24, 49, and 52-60 are newly rejected under 35 USC 112, first paragraph herein. Claims 1, 4-24, 49, and 52-60 are newly rejected under 35 USC 103 as necessitated by amendment. This action is non-final.

Claim Rejections - 35 USC § 112

2. The following is a quotation of the first paragraph of 35 U.S.C. 112:

> The specification shall contain a written description of the invention, and of the manner and process of making and using it, in such full, clear, concise, and exact terms as to enable any person skilled in the art to which it pertains, or with which it is most nearly connected, to make and use the same and shall set forth the best mode contemplated by the inventor of carrying out his invention.

3. Claims 1, 4-24, 49, and 52-60 are rejected under 35 U.S.C. 112, first paragraph, as failing to comply with the written description requirement. The claim(s) contains subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s), at the time the application was filed, had possession of the

claimed invention. Claims 1 and 49 have been amended to recite that the interconnect is bonded to an electrode. However, the application as originally filed is not believed to adequately support this recitation. In paragraph [0064] of the instant specification, it is expressly disclosed that the separator plate can be bonded to the interconnect. However, it is not disclosed that the electrode(s) are bonded to the interconnect. Paragraph [0036] discloses that the invention "allows for CTE mismatch between various components of the stack without subjecting such components, or bonds or other types of connection therebetween, to excessive stress." While this passage generally discloses bonds between components, the passage is not deemed to support the specific recitation of the interconnect bonded to the electrode as now recited in the claims. There are many possible bonds in the fuel cell stack, and the generic disclosure of component bonding, without more, is not considered to adequately support the claimed electrode-interconnect bonding.

4. The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

5. Claims 54 and 57 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. The claims depend from claim 25, which has been cancelled. Correction is required.

Claim Rejections - 35 USC § 103

6. Claims 1, 4-7, 10, 11, 19, 21, and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over Singh (U.S. Patent 4,389,467) in view of Allen (U.S. Patent 6,383,677).

Singh is directed to a molten carbonate fuel cell assembly comprising an interconnect assembly comprising a separator plate (11), and current collectors (27, 29) contacting the separator plate. The current collectors are corrugated stainless steel wire meshes which form sinusoidal cross-sectional channels (see Fig. 1; col. 4, line 27-32). The areas of the mesh contacting the separator are "first portions" and the areas of the mesh contacting the electrodes (13, 15) are "second portions." The meshes are three-dimensional "superstructures" which comprises a woven substructure. Although the fuel cell of the reference is a molten carbonate fuel cell, the instant claims do not positively recite a solid oxide fuel cell and this limitation is met by the reference. Regarding claims 1 and 59, the cathode is disclosed as being a nickel or nickel alloy, which reacts to form NiO during fuel cell operation. Thus, the cathode is a "ceramic electrode." The cathode and the current collector would inherently have different coefficients of thermal expansion since they are made of different materials.

Singh et al. do not expressly teach that current collectors are bonded to the electrode and to the separator, as recited in claim 1.

Allen is directed to a current collector structure suitable for a molten carbonate fuel cell (see col. 6, line 52). As disclosed in column 6, lines 45 and 66, current collectors (3A-C) comprising flat wires are bonded to the electrode (2) and the separator (10).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the artisan would be motivated to bond the

current collectors of Singh et al. to the electrodes and separator plates thereof. As disclosed by Allen in column 6, line 67, the bonding facilitates the assembly of the current collectors to the separator. Accordingly, the artisan would be motivated to bond the components of the fuel cell of Singh et al. together in this manner.

7. Claims 1, 4-9, 11-21, 24, 53, 56, and 59 are rejected under 35 U.S.C. 103(a) as being unpatentable over DE 19517443 in view of Allen in view of Iacovangelo et al (U.S. Patent 4,404,267).

DE '443 is directed to a molten carbonate fuel cell assembly comprising an interconnect assembly comprising a separator plate and current collectors contacting the separator plates and anodes (see translation, page 2). The current collectors are nickel-coated stainless steel wire meshes which form square, rectangular, or slanted cross-sectional channels (see Figs. 4a, 4b). The areas of the mesh contacting the separator are "first portions" and the areas of the mesh contacting the anode are "second portions." The meshes are three-dimensional "superstructures," which comprises a woven substructure. Although the fuel cell of the reference is a molten carbonate fuel cell, the instant claims do not positively recite a solid oxide fuel cell and this limitation is met by the reference.

DE '443 does not expressly teach that current collectors are bonded to the electrode and to the separator, as recited in claim 1.

Allen is directed to a current collector structure suitable for a molten carbonate fuel cell (see col. 6, line 52). As disclosed in column 6, lines 45 and 66, current collectors (3A-C) comprising flat wires are bonded to the electrode (2) and the separator (10).

Therefore, it is submitted that the artisan would be motivated to bond the current collectors of DE '443 to the electrodes and separator plates thereof. As disclosed by Allen in column 6, line 67, the bonding facilitates the assembly of the current collectors to the separator. Accordingly, the artisan would be motivated to bond the components of the fuel cell of DE '443 together in this manner.

DE '443 further does not expressly teach that the anode is ceramic, as recited in claim 59, or that the anode and the interconnect have different coefficients of thermal expansion as recited in claim 1.

Iacovangelo et al. is directed to a molten carbonate fuel cell having an anode made of metal coated ceramic particles.

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions and the combination would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Thus, it would be obvious to use the ceramic-containing anode of Iacovangelo et al. in the molten carbonate fuel cell of DE '443. Further, the anode and the interconnect of DE '443 would have different coefficients of thermal expansion, as recited in claim 1.

DE '443 further does not expressly teach that the current collectors are dimpled (claims 8 and 9) or that they define sinusoidal or hourglass-shaped channels or that the connecting portions converge (claims 19, 20, 53, 56), or that the compliance of the current collector is within the ranges defined by claims 12-14.

However, it is submitted that the disclosure of DE '443 fairly suggests the claimed shapes and ranges of compliance. On page 3 of the translation, the reference teaches that "[v]ery different mechanical and electrical characteristics of the current collector can be achieved by the different shaping of the wire mesh, i.e. different contact areas and kiss pressures both on the side to the electrode as well as on that the bipolar plate of the gas cell turned side." Accordingly, this disclosure would motivate the artisan to change the shape of the current collector to affect the mechanical and electrical characteristics. As such, the shapes recited in the instant claims are not considered to involve an inventive step over DE '443. Additionally, the ranges of compliance recited in claims 12-14 are also not considered to involve an inventive step since the reference suggests modifying the mechanical characteristics and kiss pressure of the current collector.

8. Claims 1, 4, 6, 7, 10, 11, 21, 23, 24, 49, 52, 59, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over WO 99/13522 in view of Allen.

WO '522 is directed to a solid oxide fuel cell assembly comprising an interconnect assembly comprising a separator plate (122), a silver alloy mesh (136) contacting one side of the plate, and a nickel mesh (144) contacting the other side of the plate (see abstract; Fig. 4). The

sides of the mesh contacting the separator are "first portions" and the sides of the mesh contacting the electrodes are "second portions." The meshes are "superstructures" which comprise a woven substructure, which can be defined as a discrete portion of the superstructure. The silver in mesh 136 may be combined with another material to form a composite or may be formed on stainless steel (see abstract). The mesh is welded to a collector rod which is disposed in a groove in the separator, plate, which is then sealed with a glass sealant. Thus, the mesh is "bonded" to the separator plate as recited in claims 1 and 49. Regarding claims 59 and 60, the anode is a Ni/zirconia cermet and the cathode is strontium doped lanthanum manganite. These materials have different coefficients of thermal expansion than the silver mesh, as recited in claims 1 and 49. Further with regard to claim 23, silver is considered to be a noble metal.

However, WO '522 does not expressly teach that the mesh is bonded to the electrode(s), as recited in claims 1 and 49.

Allen is directed to a current collector structure suitable for any type of planar fuel cell (see col. 1, line 39 et seq.). As disclosed in column 6, lines 45 and 66, current collectors (3A-C) comprising flat wires are bonded to the electrode (2) and the separator (10).

Therefore, it is submitted that the artisan would be motivated to bond the current collectors of WO '522 to the electrodes thereof. Such bonding would facilitate fuel cell fabrication by allowing parts to be precisely located and adhered together. Accordingly, it would be obvious to bond the mesh current collectors of WO '522 to one or both electrodes.

9. Claim 22 is rejected under 35 U.S.C. 103(a) as being unpatentable over DE 19517443 in view of Allen in view of Iacovangelo et al. as applied to claims 1, 4-9, 11-21, 24, 53, 56, and 59 above, and further in view of Minh (U.S. Patent 6,296,962).

DE 19517443 does not expressly teach that the current collectors are made of a nickel-chromium-based alloy.

Minh teaches a solid oxide fuel cell current collector that is made of a nickel-chromium or iron-chromium based material (see col. 4, line 16).

Therefore, the invention as a whole would have been obvious to one of ordinary skill in the art at the time the invention was made because the disclosure of Minh would motivate the artisan to use these materials in the current collector of DE '443. In column 4, line 14, Minh teaches that these materials are "preferably" used and that they are oxidation-resistant. As such, the artisan would be motivated to use these materials in the current collector of DE '443.

10. Claims 49, 52, 55, 58, and 60 are rejected under 35 U.S.C. 103(a) as being unpatentable over Nazmy (U.S. Patent 5,064,734) in view of DE 19517443 in view of Allen.

Nazmy is directed to a solid oxide fuel cell comprising a solid electrolyte (1), an oxygen electrode comprising La/Mn perovskite and a fuel electrode comprising Ni/zirconia cermet (see col. 3, line 40). Interconnects (7, 10) abut each electrode and are in contact with a separator plate (4). The interconnects can be made of NiCr alloy (see col. 3, lines 56 and 63), and thus have a different coefficient of thermal expansion than the electrodes.

Nazmy does not expressly teach that the interconnects comprise a superstructure which comprises a woven substructure, as recited in claim 49.

As stated above, DE '443 teaches woven interconnect structures primarily for use in molten carbonate fuel cells. However, on page 2 of the translation, it is stated that "thus at [sic] current collectors *to the use in gas cells*, in particular in fusion carbonate gas cells, the following demands are made" (emphasis added).

Accordingly, it is submitted that it would have been obvious to substitute the current collector of DE '443 for the current collector of Nazmy. The substitution of one known element for another would have yielded predictable results to one of ordinary skill in the art at the time of the invention. Further, as stated on page 2 of the translation of DE '443, "an advantage according to invention manufactured of the current collector consists of the fact that the mechanical and electrical characteristics can be varied by the choice of the strength and the feather/spring characteristics of the high-grade steel wire as well as by the kind of its processing within a wide range and be adapted to the respective requirements." Accordingly, it would only involve routine skill in the art to substitute the collectors (at least the shape and optionally the materials) for the collectors of Nazmy. Further, as disclosed in the passage above, although DE '443 is primarily concerned with molten carbonate fuel cells, is not limited thereto.

Nazmy further does not expressly teach that the interconnects are bonded to the separator plates and electrodes, as recited in claim 49.

Allen is directed to a current collector structure suitable for any type of planar fuel cell (see col. 1, line 39 et seq.). As disclosed in column 6, lines 45 and 66, current collectors (3A-C) comprising flat wires are bonded to the electrode (2) and the separator (10).

Therefore, it is submitted that the artisan would be motivated to bond the current collectors (interconnects) of Nazmy to the electrodes and separator plates thereof. Such bonding would facilitate fuel cell fabrication by allowing parts to be precisely located and adhered together. Accordingly, it would be obvious to bond the mesh current collectors of Nazmy to the electrodes and separator plates.

Regarding claims 55 and 58, the selection of these specific shapes of current collector would be obvious for the reasons stated in item 7 above.

Response to Arguments

11. Applicant's arguments filed February 11, 2008 have been fully considered but they are not persuasive. First, Applicant's arguments with regard to Singh and DE '443 are considered moot in view of the new grounds of rejection. However, with regard to WO '522, Applicants maintain the position that the claim language distinguishes over the reference. In particular, it is asserted that WO '522 does not teach the woven substructure formed into a compliant superstructure. However, as set forth in the rejection, it is asserted that WO '522 teaches one or more "woven substructures" which form the superstructure. Contrary to Applicant's argument, there is no explicit definition of these terms in the instant specification. Furthermore, the limitation "formed into said superstructure" is not seen to impart any structural attributes to the claimed superstructure. Therefore, in WO '522, a woven substructure is "formed into" a superstructure to be used in the fuel cell, as claimed. Applicant further states that WO '522 does

not teach "spaced contact zones," however, this feature is not claimed. Nevertheless, it is noted that in WO '522, even though the mesh is in a flat configuration, the surfaces are still "spaced" from each other by the thickness of the mesh.

Conclusion

12. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Jonathan Crepeau whose telephone number is (571) 272-1299. The examiner can normally be reached Monday-Friday from 9:30 AM - 6:00 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Patrick Ryan, can be reached at (571) 272-1292. The phone number for the organization where this application or proceeding is assigned is (571) 272-1700. Documents may be faxed to the central fax server at (571) 273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR

system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

/Jonathan Crepeau/
Primary Examiner, Art Unit 1795
April 3, 2008